NATURAL RESOURCES DEFENSE COUNCIL

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ATTN: PHG Project

To OEHHA Staff:

These comments are submitted on behalf of NRDC (Natural Resources Defense Council) and the Center for Public Environmental Oversight. NRDC is a nonprofit environmental policy organization with 1.2 million members and activists, more than 250,000 of whom are Californians. We are writing to comment on and support the Draft Public Health Goal (PHG) for Perchlorate in Drinking Water released in January 2011 ("OEHHA PHG Draft"). The proposed PHG is appropriate based on the best scientific information available, and it is correctly designed to protect vulnerable populations as required by statute.

The California Safe Drinking Water Act of 1996 requires that the Office of Environmental Health Hazard Assessment (OEHHA) publish PHGs for contaminants in drinking water based exclusively on public health considerations. Cal. Health & Safety Code § 116365(c)(1). The statute requires that the PHG be reviewed to incorporate new science every five years. Cal.
Health & Safety Code § 116365(e)(1). The most recent PHG was published in March of 2004. The revised PHG is therefore already nearly two years behind the statutory schedule. We urge you to move forward quickly to finalize the PHG.

We are extremely concerned about the widespread presence of perchlorate in California drinking water. This chemical contaminates the drinking water of an estimated ten million Californians, and as of 2009 it has been found in 92 public water systems and 297 drinking water sources at levels at or above 4 parts per billion (ppb). Perchlorate is known to disrupt the function of the thyroid gland in humans, and can have serious and irreversible adverse effects on the development of the brain during fetal life and probably also in infancy. This chemical must be stringently regulated in drinking water, as required by law, so that all susceptible populations are protected and so that no adverse effects will occur.

The science on perchlorate has advanced significantly since the last PHG was finalized in 2004. Since that time, a fuller understanding has emerged of the importance of iodine nutritional status as a major modifier of perchlorate risk.[i] Several studies have been published showing concentration of perchlorate in human breast milk,[ii] [iii] and several major new human epidemiological studies have shown associations between perchlorate exposure and thyroid hormone status in human infants.[iv] [v] In addition, as described in the OEHHA PHG Draft, it has become clear that infants are the most susceptible subpopulation and it is necessary to recalculate the PHG to adequately protect infants.

We commend OEHHA for incorporating these significant scientific advances in understanding into a revised PHG. In particular, the following scientific decisions in the OEHHA draft are appropriate to protect public health, and are scientifically well-founded.

Preventing iodide uptake inhibition is an appropriate choice
The California Safe Drinking Water Act states that the PHG "*shall* take into account"the "relationship between exposure to the contaminant and increased body burden and the degree to which increased body burden levels alter physiological function or structure in a manner that may significantly increase the risk of illness." Cal. Health & Safety Code § 116365 (c)(1)(C)(iii) (emphasis added). It is therefore appropriate to set a PHG that is designed to prevent perchlorate-related disruption of iodide uptake into the thyroid gland. Levels of exposure that can to lead to disruption of iodide uptake significantly increase the risk of illness, specifically neurodevelopmental harm in the fetus and infant. The scientific understanding of the principal mechanism of action for perchlorate toxicity makes it possible to set a PHG to prevent perturbation of that toxicity pathway. The National Academy of Sciences has recommended that, wherever possible, chemical testing and risk assessments should be based on preventing perturbation of 'toxicity pathways', rather than on endpoints. Such an approach is appropriately public health-protective because it is designed to prevent the toxic endpoint from occurring.[vi] Therefore OEHHA made an appropriate decision to use iodide inhibition as the pathway of interest.

The Greer et al. study has serious limitations, but is useful in tandem with other approaches
In comments submitted by NRDC on the prior PHG, we expressed serious concerns about the use of the Greer et al. (2002)[vii] study for use in the calculation of an appropriate PHG. Concerns about this study include ethical issues regarding their use of human subjects and the adequacy of the informed consent in the study. Scientific concerns include the small sample size, the fact that the participants were all healthy adults, mostly male, and iodine-replete. Despite the relatively homogenous and small study population, there was considerable variability in the response to perchlorate among the subjects in the study; this variability is not well-understood or explained, and it resulted in imprecise estimates of effect. For these reasons, the Greer study is far from an ideal basis for calculation of a PHG. Use of a different study that is larger and that includes vulnerable populations would be preferable. However, it is also reasonable to use more than just one study as the basis for the PHG. The alternative calculation

presented in Appendix 1 is a highly valuable approach, because it uses a very different data set as a basis for the calculation. Interestingly, the result is quite similar to the result obtained using the Greer study and the current OEHHA assumptions. It would be valuable to present these calculations in the main body of the document rather than in an appendix, and as an alternative (rather than secondary) calculation of the PHG.

The infant is an appropriate choice as a susceptible group
The California Safe Drinking Water Act requires that the PHG "*shall* take into account" the "[a]dverse health effects the contaminant has on members of subgroups that comprise a meaningful portion of the general population, including, but not limited to, infants . . . or other subgroups that are identifiable as being at greater risk of adverse health effects than the general population when exposed to the contaminant in drinking water." Cal. Health & Safety Code § 116365(c)(1)(C)(ii) (emphasis added). In fact, the statute requires that, for risk assessments "that involve infants and children," OEHHA "*shall* assess" the following if information is available:

> (1) Exposure patterns, including, but not limited to, patterns determined by relevant data, among bottle-fed infants and children that are likely to result in disproportionately high exposure to contaminants in comparison to the general population.
> (2) Special susceptibility of infants and children to contaminants in comparison to the general population.

Id.§ 116365.2(b).

The previous California PHG was based on pregnant woman as the most susceptible group, but as NRDC pointed out in our comments submitted in January 2003, the infant should be considered more susceptible. Neonates and infants are most susceptible, both due to susceptibility to irreversible neurological effects from perchlorate-associated iodine deficiency in the central nervous system, and due to increased exposure because of a greater relative consumption of fluids as a proportion of body weight. Breastfeeding neonates and infants must also be considered susceptible due to the evidence that perchlorate is actively sequestered in breast milk. It is therefore appropriate for OEHHA to calculate a PHG based on infant exposure to perchlorate.

It is appropriate to look at infant intake both from water and from diet. However, OEHHA does not appear to have calculated infant exposure to perchlorate from breastmilk. Such a calculation should be done to assure that the active secretion of perchlorate in breastmilk does not result in higher exposures in breastfed infants compared to bottle fed infants. Increased exposure to breastfed infants would be expected based on animal studies and modeling.[viii] Pearce et al. (2007) reported that 47 percent of breast milk samples from women in Boston did not contain enough iodine to meet recommended infant iodine intake levels – presumably due both to dietary deficiencies and to the interference of iodide uptake into the breast by perchlorate. That same study and others have reported elevated levels of perchlorate in breastmilk, above levels found in maternal urine or in local drinking water. It would therefore be

appropriate to perform a calculation that would account for both the increased perchlorate dose to infants that are exclusively breastfed, and the reduction of iodide intake that would occur for these infants due to perchlorate's inhibition of iodide into the breastmilk. The American Academy of Pediatrics recommends: "Exclusive breastfeeding for approximately the first six months and support for breastfeeding for the first year and beyond as long as mutually desired by mother and child."[ix] The breastfed infant should be considered separately as a vulnerable group.

Uncertainty adjustment may be insufficient
The use of an uncertainty factor (UF) of 10 to adjust for a list of issues described on pp. 108-109 of the OEHHA PHG Draft document is reasonable, but may be insufficient to adjust for the many sources of uncertainty in the risk assessment. Numerous highly susceptible subgroups exist and it is not clear that a 10-fold UF is sufficient to adjust for all of these uncertainties. For example, the range of variability in the Greer study alone spans approximately 10-fold at some dose levels, and this study population included neither iodide deficient people, nor pregnant women, infants, or other vulnerable groups. When such groups are included, it is highly likely that the range of variability spans far more than one order of magnitude.

The complete removal of the 3-fold database UF also seems rash in light of the fact that the Greer study has been criticized for numerous deficiencies, including small sample size and short duration, and that there is remaining uncertainty as to whether there are other mechanisms of perchlorate toxicity, including potential immunological effects. In particular, perchlorate suppresses the phagocytic capacity of peritoneal macrophages, as discussed briefly on pp. 30-31 of the OEHHA PHG Draft. This finding has not been appropriately investigated, and it should not be dismissed, in light of the fact that this test is used as an important and fairly specific screen for immunotoxic chemicals. A database UF of 3 should be retained to adjust for these remaining scientific uncertainties.

In addition to the above issues, OEHHA chose appropriately to adjust the Relative Source Contribution (RSC) downward to account for the understanding that food is a major exposure pathway. Finally, the use of a Benchmark Dose approach to calculation of the Point of Departure (instead of the use of a LOAEL/NOAEL) is scientifically appropriate and mathematically robust. Overall, the OEHHA PHG Draft for perchlorate is a carefully-prepared, scientifically-solid, document that carries out the requirements of the California Safe Drinking Water Act to protect vulnerable populations. This document, however, places OEHHA at least two years behind the deadline to revise and update the perchlorate PHG. Therefore we urge OEHHA to move forward quickly to finalize the PHG before additional time elapses.

Thank you for considering our comments.

Sincerely,

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[i] Dasgupta PK, Kirk AB, Dyke JV, Ohira S (2008). Intake of iodine and perchlorate and excretion in human milk. Environ Sci Technol 42(21):8115-8121.

[ii] Pearce EN, Leung AM, Blount BC, Bazrafshan HR, He X, Pino S, Valentin-Blasini L, Braverman LE (2007). Breast milk iodine and perchlorate concentrations in lactating Boston-area women. J Clin Endocrinol Metab 92(5):1673-1677.

[iii] Dasgupta PK, Kirk AB, Dyke JV, Ohira S (2008). Intake of iodine and perchlorate and excretion in human milk. Environ Sci Technol 42(21):8115-8121.

[iv] Steinmaus C, Miller MD, Smith AH (2010). Perchlorate in drinking water during pregnancy and neonatal thyroid hormone levels in California. J Occup Environ Med 52(12):1217-1224.

[v] Blount BC, Pirkle JL, Osterloh JD, Valentin-Blasini L, Caldwell KL (2006). Urinary perchlorate and thyroid hormone levels in adolescent and adult men and women living in the United States. Environ Health Perspect 114(12):1865-1871.

[vi] Toxicity Testing in the 21st Century: A Vision and a Strategy (2007) National Academies Press, Washington, DC.

[vii] Greer MA, Goodman G, Pleus RC, Greer SE (2002). Health effects assessment for environmental perchlorate contamination: the dose response for inhibition of thyroidal radioiodine uptake in humans. Environ Health Perspect 110(9):927-937.

[viii] Clewell RA, Merrill EA, Yu KO, Mahle DA, Sterner TR, Fisher SJ, Gearhart JM (2003). Predicting neonatal perchlorate dose and inhibition of iodide uptake in the rat during lactation using physiologically-based pharmacokinetic modeling. Toxicol Sci 74:416-436.

[ix] American Academy of Pediatrics Policy Statement. Breastfeeding and the use of human milk. Pediatrics (2005) 115(2):496-506.